

## Two new species of nematodes (Trichostrongyloides) from the marsupial mole *Notoryctes typhlops* (Stirling)

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**Abstract.** — *Auastrostrongylus notoryctis* sp. n. and *Nicollina peregrina* sp. n. are described from the intestine of the marsupial mole *Notoryctes typhlops* (Stirling, 1889) from central Australia. *A. notoryctis* differs from related species in the gross asymmetry of the bursa and short spicules. *N. peregrina* differs from congeners in having fewer (5) body ridges and in the morphology of the dorsal ray. The synopse of this species is the most primitive known within the Nicollinidae. Both nematode species are interpreted as captures from recent macropodids on the one hand and monotremes on the other.

**Résumé.** — *Auastrostrongylus notoryctis* sp. n. et *Nicollina peregrina* sp. n., parasites de la taupe marsupiale *Notoryctes typhlops* (Stirling, 1889) de l'Australie centrale, sont décrits. *A. notoryctis* se distingue des autres espèces du genre par une bourse caudale asymétrique et des spicules très courts. *N. peregrina* possède cinq crêtes au lieu de douze chez les espèces les plus proches et se distingue aussi par la morphologie de la côte dorsale. Le synopse de cette espèce est le plus primitif connu chez les Nicollinidae. Les deux espèces de Nématodes parasites peuvent probablement être interprétés comme des « captures » à partir des Macropodidae récents et des Monotrèmes.

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No helminth parasites have been reported to date from the marsupial mole, *Notoryctes typhlops* (Stirling, 1889), probably because of its occurrence in remote inland areas of Australia and because its burrowing habits make it difficult to collect (CORBETT, 1975). Recently, we have had the opportunity of examining three moles collected in the vicinity of Alice Springs, Northern Territory, each of which was parasitised by two species of trichostrongyle nematodes. Although the moles had been frozen, and the nematodes were not very well preserved, sufficient morphological details were obvious to indicate that the nematodes represented new species of the genera *Auastrostrongylus* Chandler, 1924, and *Nicollina*, Baylis, 1930.

Measurements are given in the text in mm as the range of five values. Type specimens are deposited in the South Australian Museum, Adelaide (SAM), the Muséum national d'Histoire naturelle, Paris (MNHN), and the Australian Helminthological Collection, Adelaide (AHC).

**Austrostrongylus notoryctis** sp. n.

(Fig. 1)

TYPE MATERIAL : Holotype ♂, allotype ♀ in SAM no. V3608, 3609 ; 2 ♂, 2 ♀, paratypes in SAM no. V3610, 3613 ; 2 ♂, 2 ♀ paratypes in MNHN no. 535 HD ; 8 ♂, 6 ♀ paratypes in AHC no. 12152.

HOST : *Notoryctes typhlops* (Stirling, 1889) (Marsupialia).

LOCATION IN HOST : Anterior intestine.

GEOGRAPHIC ORIGIN : Yuendumu Station, Northern Territory, Australia, collected by P. JALAPAL-JARI, 04.X.1982.

DESCRIPTION

Small nematodes, coiled 4-5 times in ventral spiral.

Synlophe : In both sexes, 2 large lateral floats and 8 cuticular ridges in mid-body region ; 5 ridges on ventral body surface oriented from right to left with a decrease in size from left to right ; 2 smallest ridges disappear in posterior region of body of male ; no ridges present on dorsal aspect of body ; right float with 2 large dorsal and 1 ventral ridge ; left float with folds but no ridges. Ridges and floats arise at level of cephalic vesicle, enlarge posteriorly ; terminate in male at level of bursa ; in female at level of vulva.

Head : Mouth opening with 6 small lips, each with internal labial papilla at base ; 2 amphids and 4 submedian external papillae present. Buccal capsule small, subglobular in lateral view, hexagonal in transverse section, walls well sclerotised ; single dorsal tooth and 2 smaller sub-ventral teeth present ; prominent cephalic vesicle present ; œsophagus claviform, slender, excretory pore usually just anterior to but may occasionally be posterior to œsophago-intestinal junction ; nerve ring not seen ; deirids at level of excretory pore.

*Male* : Length 2.7-3.1 ; cephalic vesicle 0.065-0.080 ; buccal capsule 0.006-0.010 × 0.015-0.017 ; dorsal tooth 0.004-0.005 long ; œsophagus 0.26-0.27 ; excretory pore 0.20-0.29 from anterior end ; spicules 0.23-0.27 long ; handles 0.07-0.09 long, shafts 0.15-0.19 long, alate ; spicules recurved at distal extremity, with bilobed tip and needle-like accessory ending ; spicule tips joined in transparent flange of spicular material. Gubernaculum rectangular in ventral view, 0.05-0.08 long. Bursa asymmetrical ; right latero-ventral lobe much larger than left ; ray 2 slender directed anteriolaterally, distinctly separate from ray 3 ; ray 3 similar in thickness to rays 4 and 5, aligned with them ; ray 6 more slender than rays 4,5, directed dorso-laterally, ray 8 slender, left ray markedly longer than right ; both arise close to lateral trunk ; ray 9 long slender, swollen at base, with two lateral branches arising near distal extremity, often at slightly different levels ; ray 9 terminating in 4 tiny branches. Genital cone small non sclerotised.

*Female* : Length 3.2-3.8 ; cephalic vesicle 0.075-0.080 ; buccal capsule 0.007-0.009 × 0.017-0.021 ; dorsal tooth 0.005-0.008 ; œsophagus 0.29-0.35 ; excretory pore 0.28-0.35 from anterior end ; vulva 0.44-0.64 from posterior end ; didelphic ; vagina vera very short ; ovejector asymmetrical, anterior portion of vestibule 0.065-0.095, always longer than posterior portion, 0.035-0.055 ; sphincters and infundibula approximately equal. Tail 0.11-0.15, conical, tapering, ending in simple spike 0.013-0.020 long ; egg ellipsoidal, 0.035-0.050 × 0.020-0.030.

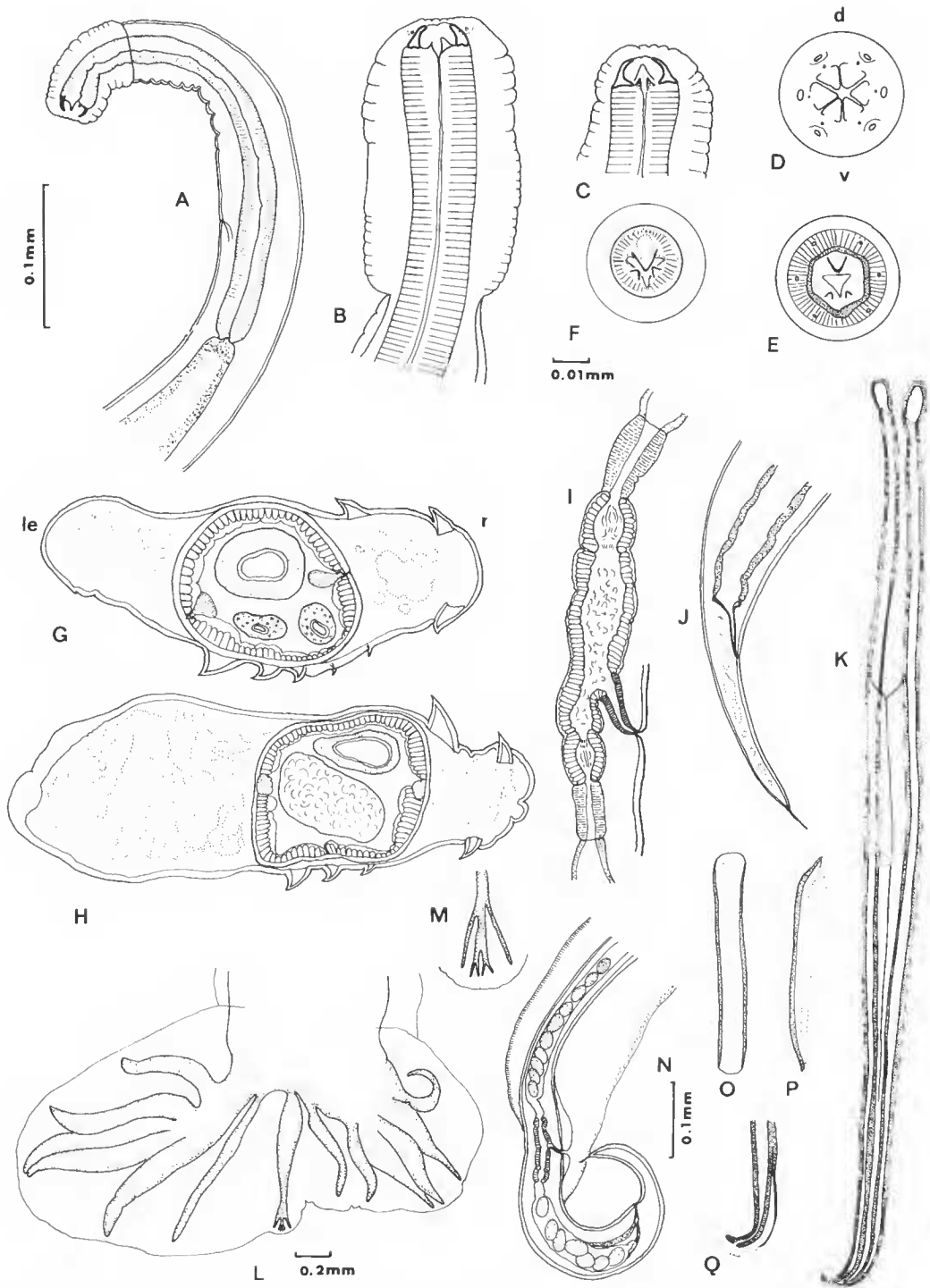


FIG. 1. — *Austrostrongylus notoryctis* sp. n. : A, anterior end, left lateral view ; B, head, left lateral view ; C, head, ventral view ; D, apical view of mouth and papillae ; E, optical transverse section through buccal capsule showing dorsal and sub-ventral teeth ; F, optical section through anterior extremity of oesophagus showing teeth and dorsal oesophageal gland ; G, body section, male, just posterior to oesophagus ; H, body section, male, anterior to spicules ; I, ovejector, lateral view ; J, tail, female, lateral view ; K, spicules, ventral view ; L, bursa, ventral view ; M, termination of dorsal ray, ventral view ; N, posterior extremity of body, female, showing lateral floats, right lateral view ; O, gubernaculum, ventral view ; P, gubernaculum, lateral view ; Q, spicule tip, oblique view. (Scale lines : figs. A, J to same scale, 0.1 mm ; figs. B-H, K, M, O-Q same scale, 0.01 mm ; figs. I, L same scale, 0.2 mm ; fig. N, scale 0.1 mm. d dorsal, le left, r right, v ventral.)

**Nicollina peregrina** sp. n.

(Fig. 2)

TYPE MATERIAL : Holotype ♂, allotype ♀ in SAM no. V3620, 3621, 5 ♂, 5 ♀, paratypes in SAM no. V3622, 3631 ; 5 ♂, 5 ♀ paratypes in MNHN no. 534 HD ; 39 ♂, 36 ♀ paratypes in AHC no. 12153.

HOST : *Notoryctes typhlops* (Stirling, 1889) (Marsupialia).

LOCATION IN HOST : Anterior intestine.

GEOGRAPHIC ORIGIN : Yuendumu Station, Northern Territory, Australia, collected by P. JALAPALLARI, 4.X.1982.

DESCRIPTION

Small straight nematodes, not spirally coiled.

Synlophe : Asymmetrical, composed principally of 5 ridges which commence immediately posterior to cephalic vesicle and extend to bursa of male and tail of female. Lateral ridges largest ; sub-ventral ridges smaller, oriented dorsally. Single small ventral ridge oriented towards the left. In area of vulva, ventral ridge disappears ; present in posterior region of female body as a tiny ridge. In posterior region of male, 3 tiny extra sub-ventral ridges appear ; size gradient of ridges increases from ventral to lateral positions. Axis of orientation of synlophe towards left.

Head : Mouth opening surrounded by 6 tiny lips each with an internal labial papilla at base ; 2 amphids and 4 submedian external papillae present. Buccal capsule round in section, subglobular in lateral view, walls well sclerotised, with triangular dorsal tooth projecting into lumen ; ventral teeth absent. Cephalic vesicle prominent. Œsophagus long, slender ; nerve ring not seen ; excretory pore anterior to œsophago-intestinal junction ; deirids at level of excretory pore.

*Male* : Length 3.5-4.3 ; cephalic vesicle 0.06-0.07 ; buccal capsule 0.008-0.010 × 0.013-0.019, tooth 0.003-0.005 ; œsophagus 0.26-0.30 ; excretory pore 0.22-0.29 from anterior end ; deirids 0.23 from anterior end ; spicules 0.25-0.29 long, handle 0.08-0.10 long ; shaft 0.17-0.19 long with broad alae ; spicules terminate in 2 points, external point simple, sharp ; internal point leads to striated terminal region of spicule ; end of spicules surrounded by folded transparent flange. Gubernaculum elongate, slender 0.06-0.09 long. Bursa symmetrical, dorsal lobe poorly developed. Rays 2-5 equal in thickness ; ray 6 more slender ; rays arranged in pattern 1-3-1 ; ray 8 slender, originates from the base of the ray 9. Ray 9 long, gives off 2 lateral branches at 2/3 length then divides near distal extremity, with final subdivision into 4 tiny branches. Origin of lateral branches often asymmetrical ; extra branches sometimes present anterior to main lateral branches. Genital cone poorly developed ; papilla 0, single ; papillae paired, not prominent.

*Female* : Length 3.8-4.9 ; cephalic vesicle 0.06-0.08 ; œsophagus 0.27-0.31 ; buccal capsule 0.008-0.012 × 0.017-0.021 ; tooth 0.005-0.008 ; excretory pore to anterior end 0.19-0.23 ; deirid to anterior end 0.22 ; didelphic ; vulva 0.68-0.94 from posterior extremity ; vagina vera very short ; ovejector asymmetrical, anterior part of vestibule 0.055-

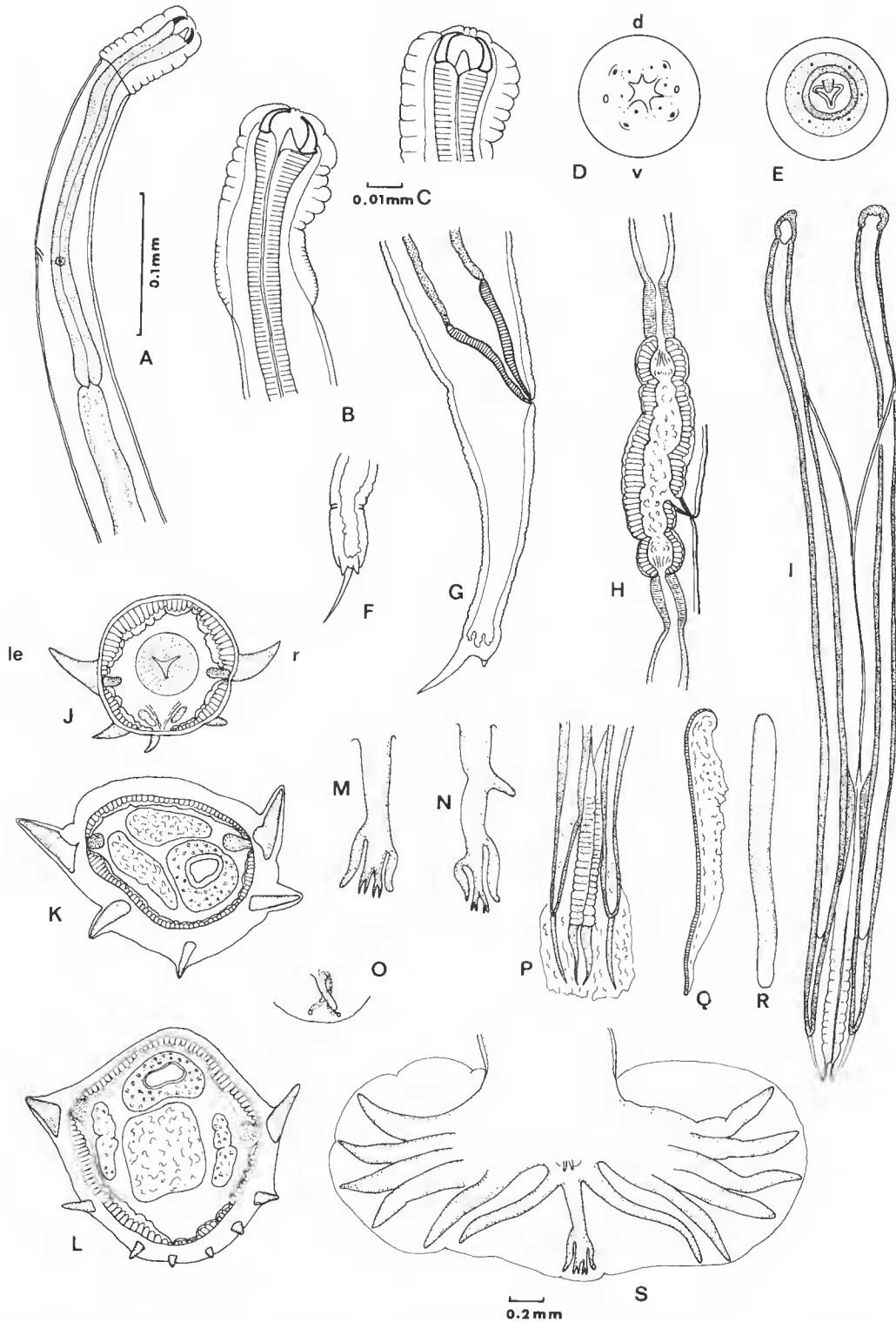


FIG. 2. — *Nicollina peregrina* sp. n. : A, anterior end, left lateral view ; B, head, left lateral view ; C, head, ventral view ; D, apical view of mouth and papillae ; E, optical section through buccal capsule showing dorsal tooth ; F, tip of tail, ♀, ventral view ; G, tail, ♀, lateral view ; H, ovejector, lateral view ; I, spicules, ventral view ; J, body section, ♀, level of excretory pore ; K, body section, ♀, mid-body ; L, body section, ♂, posterior end ; M, N, dorsal ray, ventral view ; O, genital cone, ventral view ; P, dissected spicule tips, ventral view ; Q, gubernaculum, lateral view ; R, gubernaculum, ventral view ; S, bursa, ventral view. (Scale lines : A, scale 0.1 mm ; B-R, to same scale 0.01 mm ; S, scale 0.2 mm. d dorsal, le left, r right, v ventral.)

0.090, longer than posterior part, 0.035-0.060 ; sphincters and infundibula of approximately equal size. Tail 0.08-0.20 long with 2 tiny ventral projections, and dorsal spine 0.01-0.03 long ; eggs ellipsoidal, 0.050-0.060 × 0.025-0.030.

## DISCUSSION

*Austrostrongylus notoryctis* sp. n. has morphological characters typical of the genus, with two lateral body floats, five ventral body ridges, two dorsal and one ventral ridge on the right float, and a left float without obvious ridges. The ridge pattern, the presence of two lateral floats and the absence of a sclerotised genital cone place the species unequivocally in the genus *Austrostrongylus*. Within the genus, *A. notoryctis* is immediately distinguished from all species except *A. victoriensis* Cassone, 1983, by its short spicules (0.23-0.27 mm). The closest species to these two is *A. minutus* Johnston and Mawson, 1939, with spicules 0.35-0.43 mm long. Both *A. notoryctis* and *A. victoriensis* have an asymmetrical bursa with the right lobe larger than the left, however, in *A. victoriensis* the only marked asymmetry occurs in ray 2. In *A. notoryctis*, all rays (except 9) show some asymmetry. The long wide ray 9 of *A. notoryctis* with divisions close to the distal extremity clearly distinguishes the species from *A. victoriensis*, as does the presence of a ridge on the left float of *A. victoriensis* which is absent in *A. notoryctis*. The marked asymmetry of the bursa is an evolved rather than a primitive character within the genus, indicating a close phyletic relationship between this species and congeners parasitic in *Macropus rufogriseus* (Desmarest, 1817) (*A. paratypicus* Mawson, 1973) and *Wallabia bicolor* (Desmarest, 1804) (*A. victoriensis*). Because of this it is most likely that *A. notoryctis* was acquired by capture from a macropodid host, rather than representing a long established and independent evolutionary lineage. No members of *Austrostrongylus* are currently known from macropodids inhabiting central Australia, the evolution of the genus having taken place primarily in the macropodid subgenus *Prionotemnus*, which occurs in less arid coastal areas. However, collections of parasites from central Australian marsupials are limited and further collecting may reveal additional species of *Austrostrongylus* in this region.

The synopse of *Nicollina peregrina* sp. n. is characterised by five ridges on the ventral half of the body with an orientation towards the left. It therefore belongs within the genus *Nicollina* and lies closest to *N. tachyglossi* (Baylis, 1930) and *N. spearei* Durette-Desset and Cassone, 1983. It differs from these species in having only five body ridges, compared with 12 and 15 respectively in the two congeners. The characters of the bursa, morphology of the dorsal ray, and the details of the female tail confirm its position within *Nicollina* although a small number of body ridges is a primitive character within trichostrongyloid genera (DURETTE-DESSET, 1971) suggesting that the new species with only five ridges is a particularly primitive member of the genus.

The general features of the synopse of *N. peregrina* also show a remarkable resemblance to those of *Heligmonella spira* Mönnig, 1927, a parasite of an African rodent *Thryonomys swinderianus* (Temminck), the latter differing only in the presence of additional dorsal ridges. *Heligmonella* was considered by DURETTE-DESSET (1971, 1983) as the most primitive member of the Heligmonellidae, a family of nematodes which has evolved principally in rodents. The similarity between the synophes of *H. spira* and *N. peregrina* is consi-

dered here as further evidence of a relationship between primitive Nicollinidae and primitive Heligmonellidae as suggested by DURETTE-DESSET and CHABAUD (1981).

The genus *Nicollina*, apart from the new species, is restricted to monotremes (*Tachyglossus aculeatus* Shaw, 1792) and the occurrence of *N. peregrina* in *Notoryctes* is most readily explained by a transfer of parasites to the mole from *Tachyglossus* which occurs, if uncommonly, in the same regions as *Notoryctes* (Augee, 1983). The presence of an extremely primitive synlophe in *N. peregrina* could be taken as evidence that the genus evolved initially in *Notoryctes* and subsequently invaded monotremes, but it is much more likely that the reverse is true given the variety of synlophe forms already known within *Nicollina*. Further collecting may reveal additional species of *Nicollina* in *Tachyglossus* with primitive synlophes akin to that of *N. peregrina*.

*Notoryctes* therefore harbour two species of trichostrongyloid nematodes, the first, *A. notoryctis*, belonging to a specialised genus of Herpetostrongylidae which has evolved principally in recent Macropodidae, and the second, *N. peregrina* belonging to a related lineage, the Nicollinidae which has evolved principally in monotremes. Both nematode species are best interpreted as transfers to moles from other, unrelated host groups, and give no information on the relationships of *Notoryctes*. Its association with the Dasyuroidea (see JOHNSTON 1983) is not specifically supported by its nematode parasites, but nor is its possible alliance with the phalangers (CALABY *et al.* 1974) since although *Austrostrongylus* and the related genus *Paraustrostrongylus* Mawson, 1973 are characteristically parasites of Phalangeroidea, *A. notoryctis* belongs clearly to a group of species which have evolved in *Macropus* spp., long after any possible separation of *Notoryctes* from the Phalangeroidea.

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